PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B01D 46/44 — A1

(11) International Publication Number: WO 97/20615

(43) International Publication Date: 12 June 1997 (12.06.97)

(21) International Application Number: PCT/SE96/01541

(22) International Filing Date: 26 November 1996 (26.11.96)

(30) Priority Data:
9504324-6 1 December 1995 (01.12.95) SE

(71)(72) Applicant and Inventor: ANDERSSON, Per, Otto [SE/SE]; Askrikegatan 1, S-115 57 Stockholm (SE).

(74) Agents: NILSSON, Karl et al.; Stenhagen Patentbyrå AB, P.O. Box 4630, S-116 91 Stockholm (SE).

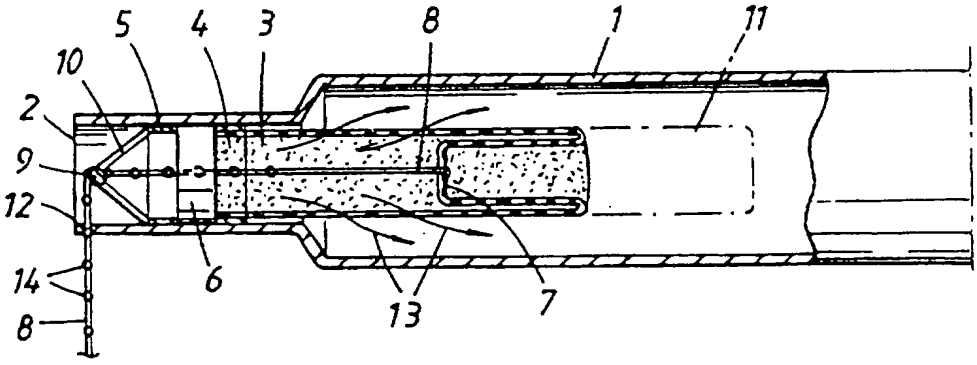
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: AN ARRANGEMENT RELATING TO BAG-LIKE FILTERS

(57) Abstract

The invention relates to an arrangement in ventilation systems which includes ducts (1) in which bag-like filters (3) are accommodated. With the intention of balancing the air flows in the ducts, the filters are constructed to generate a high pressure drop and to be throttled individually to achieve a desired air throughflow capacity. Throttling of the filters is preferably effected with the aid of a filter adjustment wire (8) attached to the bottom part (7) of respective filters and by means of which the filter bottom part (7) can be drawn-in to a desired extent into the filter (3).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	**GB**	United Kingdom	**MW**	Malawi
AT	Austria	**GE**	Georgia	**MX**	Mexico
AU	Australia	**GN**	Guinea	**NE**	Niger
BB	Barbados	**GR**	Greece	**NL**	Netherlands
BE	Belgium	**HU**	Hungary	**NO**	Norway
BF	Burkina Faso	**IE**	Ireland	**NZ**	New Zealand
BG	Bulgaria	**IT**	Italy	**PL**	Poland
BJ	Benin	**JP**	Japan	**PT**	Portugal
BR	Brazil	**KE**	Kenya	**RO**	Romania
BY	Belarus	**KG**	Kyrgystan	**RU**	Russian Federation
CA	Canada	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CF	Central African Republic			**SE**	Sweden
CG	Congo	**KR**	Republic of Korea	**SG**	Singapore
CH	Switzerland	**KZ**	Kazakhstan	**SI**	Slovenia
CI	Côte d'Ivoire	**LI**	Liechtenstein	**SK**	Slovakia
CM	Cameroon	**LK**	Sri Lanka	**SN**	Senegal
CN	China	**LR**	Liberia	**SZ**	Swaziland
CS	Czechoslovakia	**LT**	Lithuania	**TD**	Chad
CZ	Czech Republic	**LU**	Luxembourg	**TG**	Togo
DE	Germany	**LV**	Latvia	**TJ**	Tajikistan
DK	Denmark	**MC**	Monaco	**TT**	Trinidad and Tobago
EE	Estonia	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**UG**	Uganda
FI	Finland	**ML**	Mali	**US**	United States of America
FR	France	**MN**	Mongolia	**UZ**	Uzbekistan
GA	Gabon	**MR**	Mauritania	**VN**	Viet Nam

AN ARRANGEMENT RELATING TO BAG-LIKE FILTERS

The present invention relates to an arrangement in ventilation systems having ducts which accommodate hollow filters such as bag-like filters that are made of filter fabric which generates a high pressure drop and the open end parts of which filters connect sealingly with the walls of said ducts.

Ventilation systems typically include a central air-processing units and fans which function to transport both supply air and exhaust air through ducts intended herefor. The processed air is distributed in the duct system to openings through which an exchange of room air takes place in predetermined volumes in those rooms and the like that are connected to the ventilation system. The openings accommodate devices which function respectively to spread air into and remove stale air from the rooms concerned. The devices also include adjusting means which can be set to deliver and remove the correct volume of air to and from said rooms.

The person skilled in this art will be well aware of the problems associated with such adjustment means. Low differential pressures between rooms and ducts are used traditionally as airflow propelling means, and partly also for reasons of economy.

Known methods of controlling the supply and exhaust air flows with the aid of low pressure differentials are unsatisfactory and are unable to provide a perfect result even with the assistance of specialists in the field. A result that may initially have been relatively satisfactory will likely be impaired with time or when extending the system, therewith requiring the whole system to be readjusted or tuned.

With the intention of facilitating adjustments to the system, there have been developed constant flow devices which maintain a constant air flow even when changes are made to the ducting

system. These devices, however, require higher differential pressures and higher energy inputs than in the former case and also generate unacceptable sound levels which must be dampened with the aid of sound traps inserted in the ventilation system. Each such device incurs a high cost, even though the total costs may be reduced by avoiding the use of a specialist to make the aforesaid system adjustments.

A stable air flow can be achieved in the orifices of ducts, even when extending a duct system, with a pressure differential of around 200 Pa. A condition in this regard is that the pressure drops created in the system by the transportation of air therethrough are much lower than the pressure differential, which thereby becomes essentially constant throughout the entire system.

This solution would be ideal if it were not for the fact that sound levels are generated that require the inclusion of complicated sound traps.

However, a desired low sound level can be achieved in a number of different ways. For instance, sound levels can be reduced effectively with the aid of filter fabrics, since they generate totally sound-free pressure reductions. Such fabrics have not been earlier used with the intention of consciously generating relatively high pressure drops. Such fabric, however, has highly beneficial secondary effects. For instance, it improves the quality of both the air and the environment. When using a suitable filter quality, such as F85 (EU7), the duct system will be dust-free, therewith obviating the need to clean the system, as well as being free from allergens, bacteria and even viruses that are carried on large host particles.

It will readily be seen that one problem resides in the need of a large number of filters that generate mutually different pressure drops, in order to achieve the desired balance in the system.

The object of the present invention is to provide a solution to the aforesaid problems of balancing the air flows in combination with high pressure-drop filters.

This object is achieved in accordance with the invention by balancing the air flows in the system ducts essentially by throttling or inhibiting the air throughflow capacity of individual filters. The filter capacity can be throttled or inhibited after the filter has been fitted and is preferably effected by placing on the bottom of the filter a filter adjustment wire or some equivalent device by means of which the bottom part of the filter can be drawn-in to a desired filter length, ie to the extent required to achieve an intended air throughflow. This type of filter adjustment is facilitated by the remarkable circumstance that the air throughflow decreases almost linearly with decreasing filter lengths when double folding the filter by drawing-in the bottom part of the filter. A minor part of the filter throttling effect can be achieved with the aid of mechanical throttling means.

Alternatively, a similar function can be achieved by providing a rod on the bottom part of the filter and turning or twisting the rod through an appropriate angle in relation to the open end of the filter.

Naturally, it is also possible to shorten the effective length of the filter with the aid of a tightenable cross-member or the like, or with the aid of a cross-seal. This adjustment is best made to a filter fitted to a supply air device, where the full length of the filter is readily accessible..

The invention will now be described in more detail with reference to exemplifying embodiments thereof and also with reference to the accompanying drawings in which Figures 1, 2, and 3 are longitudinal section views of filters having mutually different filter adjustment means, and Figure 4 is a curve

showing the air throughflow as a function of filter length with the filter adjustment means shown in Fig. 1.

Fig. 1 is a longitudinal section view of a duct 1 having an exhaust air orifice or opening 2. The duct 1 accommodates a bag-like filter 3 whose open end 4 is fastened to the duct opening 2 through the medium of a duct-mounted holder 5 having a collar 6 which is affixed around said opening 4. Attached to the filter bottom 7 is a filter adjustment wire 8 which extends over a rod 9 carried by arms 10 on the collar 6. The full extended length of the filter is indicated in chain lines 11. The illustrated filter bottom 7 is withdrawn into the main body of the filter by means of the filter adjustment wire 8, which is hooked firmly in a slot 12 provided in the duct wall. The air throughflow is shown by arrows 13 and the air flow has the magnitude illustrated in Fig. 4 at varying filter lengths. Despite the whole of the filter 3 being located in the path of the air flow, the air throughflow is decreased almost proportionally to the reduction in filter length. A relatively accurate adjustment to the air throughflow can be achieved by observing markings 14 on the wire 8.

Fig. 2 illustrates an alternative embodiment in which a filter adjustment rod 20 is attached at one end to the bottom part 7 of a filter 3. The other end of the rod 20 carries a knob 22 and can be firmly clamped in a recess 23 in a collar cross-member 24. The rod 20, and therewith the filter, is turned to an extent which provides the desired air flow through the filter, whereafter the rod is pressed into the recess 23.

Fig. 3 shows the filter 3 attached to a supply air opening. The filter is adjusted to provide the desired air throughflow, by first moving a cross-member 31 axially along the filter and checking the air flow through the opening 30 and then screwing the cross-member firmly in the position selected. The filter is

then fitted with a protective cover 32, which is readily removable to facilitate filter changes, etc..

Fig. 4 is a curve which illustrates the filter throttling effect achieved in particular with the filter adjustment means shown in Fig. 1, with a constant pressure drop across the filter of 200 Pa. An air flow of close to $300m^3/h$ is reduced to a little more than $100m^3/h$ by shortening the filter from 40 cm to 10 cm solely by pulling in the wire 8, wherein the latter half of the adjustment is practically linear.

It will be understood that the invention is not limited to the described and illustrated embodiments thereof and that modifications can be made within the inventive concept as defined by the following claims. For instance, the filter can be shortened by rolling-up the filter from its bottom end and locking the rolled-up part of the filter in some suitable manner, eg with the aid of a stapler. Corresponding reductions in effective surface area can be achieved by appropriate displacement of an O-ring along the filter. Maneuvering of the means shown in Fig. 1 and 2 may also be motor driven. The configuration of the filter and its bottom part may also vary in different ways.

C L A I M S

1. An arrangement in ventilation systems having ducts (1) which accommodate hollow filters such as bag-like filters (3) that are made of filter fabric which generates a high pressure drop and the open end parts (4) of which filters connect sealingly with the walls of said ducts, **characterized** in that balancing of the air flows in the system ducts is achieved essentially by throttling or inhibiting the air throughflow capacity of individual filters (3).

2. An arrangement according to Claim 1, **characterized** in that a filter adjustment wire (8) is attached to the distal end (7) of respective filters (3) as seen in the direction of air flow, such as to enable said ends to be drawn into respective filter bodies.

3. An arrangement according to Claim 1, **characterized** in that the filters (3) are provided with throttling means (31) for reducing the effective length of said filters.

4. An arrangement according to Claim 1, **characterized** in that the bottom ends (7) of respective filters (3) are twisted in relation to the open ends (4) of said filters.

Fig. 1

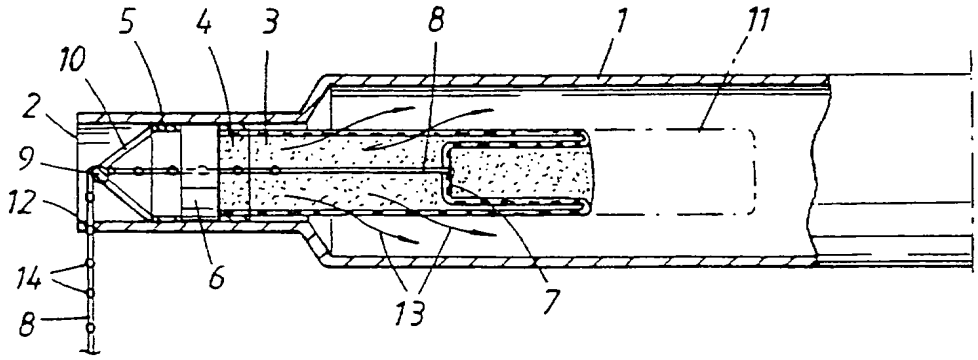


Fig. 2

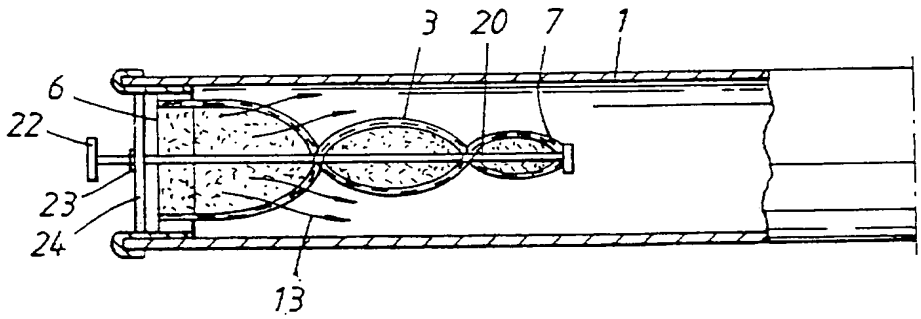


Fig. 3

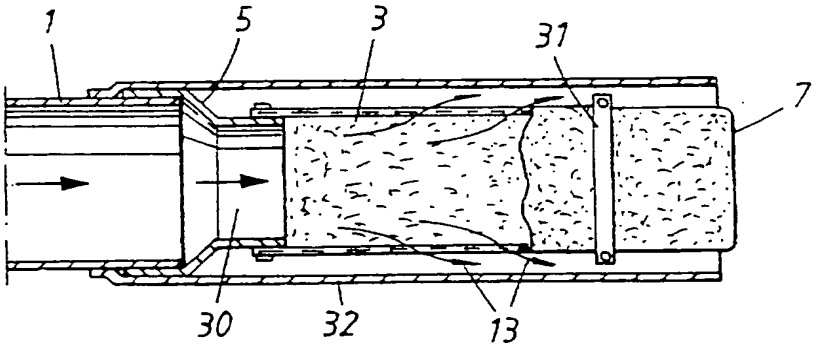
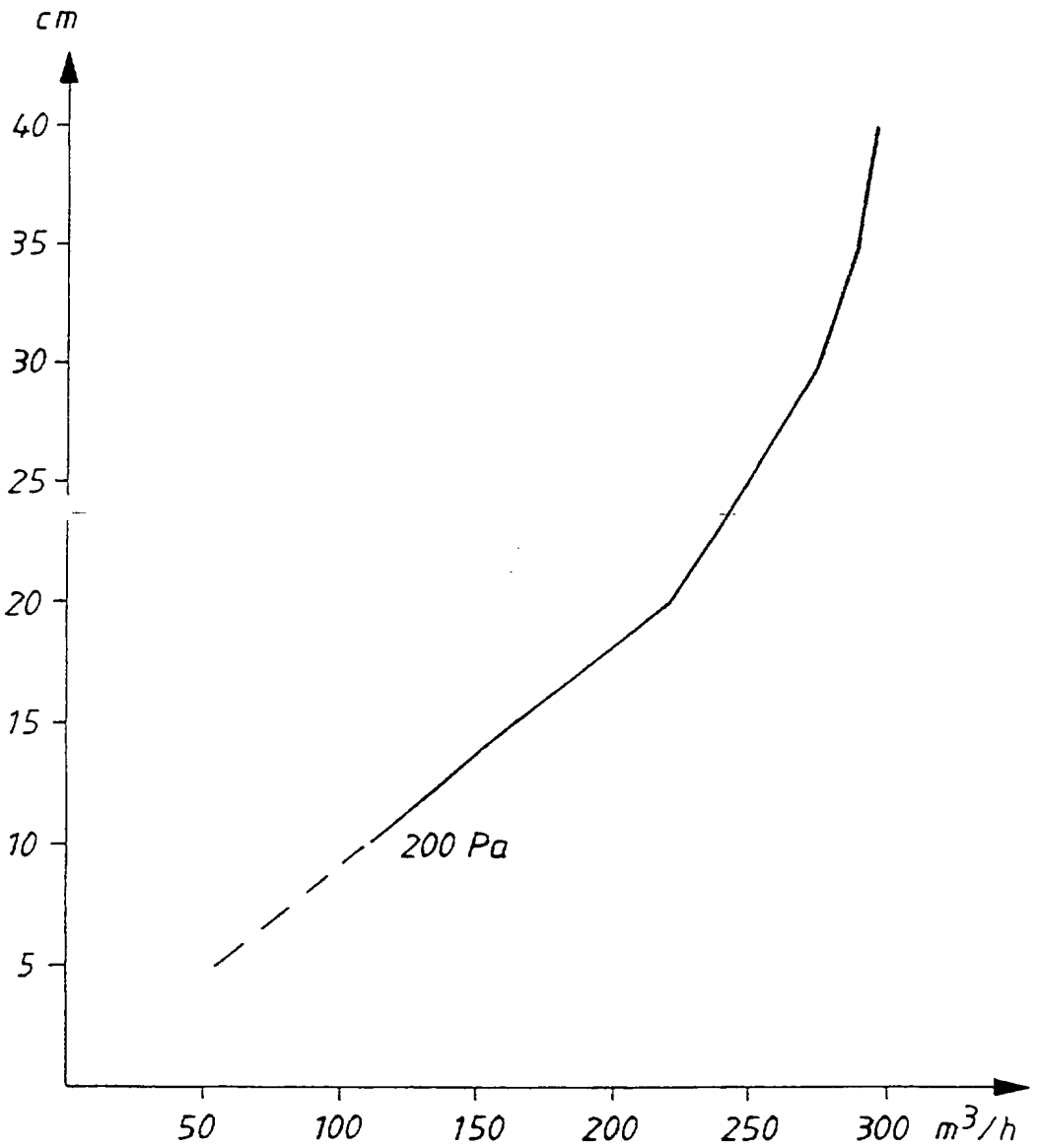


Fig. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 96/01541

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B01D 46/44
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B01D, F24F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4530272 A (KONRAD H. STOKES), 23 July 1985 (23.07.85) --	1
A	WPI/Derwent's abstract, No 90-166926, week 9022, ABSTRACT OF JP, 2106641 (MATSUSHITA ELEC WORKS), 18 April 1990 (18.04.90), abstract --	1
A	WPI/Derwent's abstract, No. 92-092737, week 9212, ABSTRACT OF JP, 4035715, (MATSUSHITA ELEC IND KK), 6 February 1992 (06.02.92), abstract -- --------	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 March 1997	29 -03- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Jan Carlerud Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

04/03/97

International application No.
PCT/SE 96/01541

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4530272 A	23/07/85	EP 0151735 A,B	21/08/85
		JP 60172329 A	05/09/85